

Marking Scheme for 4E Physics Prelim 2024

Paper 1

1	C
2	A
3	B
4	B
5	A
6	D
7	C
8	B
9	C
10	A

11	A
12	D
13	D
14	C
15	A
16	B
17	D
18	B
19	D
20	C

21	A
22	B
23	B
24	D
25	C
26	B
27	B
28	B
29	D
30	C

31	B
32	C
33	C
34	D
35	B
36	D
37	D
38	D
39	B
40	C

Paper 2

	Section A	
Qn	Solution	Marks
1(a)	Straight line starting from zero, with gradient 10m/s^2	B1
(b)	$a = 1.6 / 0.34$ $= 4.7(1)$ accept 4.7 to 5.0	M1 A1
(c)	$F = ma$ $= 0.035 \times 4.705$ $= 0.165 \text{ N}$ $0.350 - 0.165 = 0.19 \text{ N}$ (0.185 N)	M1 A1
(d)	Maximum resistive force is 0.35 N. At terminal velocity, resultant force is zero and object falls at constant speed. Resistive force = weight	B1 B1

2(a)	Correct shape between R and S	B1
	Arrows pointing towards S	B1
(b)	Correct vector drawing base on scale	M1
	Correct direction of electric force	B1
	Correct magnitude of electric force. $2.2 \times 10^{-4} \text{ N}$	A1
3(a)	Anticlockwise moment by bucket = $4 \times 1.3 = 5.2 \text{ Nm}$ Or Clockwise moment by weight of ladder = $16 \times 0.85 = 13.6 \text{ Nm}$	M1
	$13.6 - 5.2 = 8.4 \text{ Nm}$	
	$8.4 / 0.6 = 14 \text{ N}$	A1
	L is upwards (anticlockwise moment)	B1
(b)	The ladder is more stable if it is placed upright with the wider base at the bottom. (wider base area).	B1
	The centre of gravity will be lower (below the mid point of the ladder) which also increase its stability.	B1
4a	The air in the nozzle is moving randomly in high speed.	B1
	When the air molecules collide with the surface of the washer, it exerts a force. Pressure = force / Area	B1
bi	Left side higher than right side of manometer.	B1
bii	$(1 - 0.75) \times 10^5 = 13\,600 \times 10 \times h$	M1
	$H = 0.18(4) \text{ m}$	A1

5a	Transverse wave The wave propagate in the direction perpendicular to the direction of the source of vibration.	B1 B1
Bi	Period = $60 / 45 = 1.33$ s $\frac{3}{4} \times 1.33 = 1.0$ s	M1 A1
ii	$f = 45 / 60 = 0.75$ Hz $V = f \lambda$ $24 = 0.75 \times \lambda$ $\lambda = 32$ cm RS = 16 cm	 M1 A1
6 (a)	$2.4 = 3 \times 10^8 / \text{speed of light in diamond}$ speed of light in diamond = 1.3×10^8 m/s = (1.25×10^8 m/s)	M1 A1
(b)	$\sin 48 / \sin p = 2.4$ $p = 18^\circ$	M1 A1
(c)	The critical angle is the angle of incidence, in the optically more dense medium, where the angle of refraction is 90° .	B1
(d)	$\sin^{-1} (1/ 2.4) = 24.6^\circ = 25^\circ$	A1
(e)	Angle of incidence at Q (58°) is bigger than the critical angle of diamond. Light there is total internal reflection.	B1 B1
7(ai)	$V = RI$ $4.8 = 16 \times I$ $I = 0.30$ A	 A1
ii)	$6 - 4.8 = 1.2$ $V = RI$ $1.2 = R \times 0.3$ $R = 4 \Omega$	 M1 A1
b)	When X decrease, the total resistance across XY in parallel will decrease.	B1

	Volatge across Z will increase.	B1
c	When temperature increases, resistance of thermistor decrease. Voltmeter reading will decrease.	B1 B1
8(a)	6 half life 125 counts per min	B1 B1
(b)	Source Y Able to last the examination period but not to remain in the blood for too long.	B1 B1
(c)	Alpha radiation cannot penetrate through the body for detection. It has high ionizing power, thus it is harmful to the body cells.	B1 B1
(d)	${}^0_{-1}\beta$	B1
9(a)	$Q = mc \Delta\theta$ $= 0.14 \times 4\,200 \times (100 - 24)$ $= 44\,688 \text{ J}$ $= 45\,000 \text{ J}$	M1 A1
(b)	$E = P t = V^2 t / R = 24 \times 24 \times 250 / 2.5$ $= 57\,600 \text{ J}$ $= 58\,000 \text{ J}$	M1 A1
(c)	The temperature increase in a decreasing rate. At a higher temperature, more energy is transferred from the water to the surroundings due to radiation.	B1 B1
(d)	Temparature remains constant. Energy is absorbed to overcome the intermolecular forces between the particles. / Potential energy of the molecules increases.	B1 B1
(e)	Air is a poor conductor so less heat is transferred away. The pockets reduce the convection current of the air within the insulation layers.	B1 B1

10(a)	$K_e = \frac{1}{2} mv^2$ $= \frac{1}{2} \times 18\,000 \times 12 \times 12$ $= 1\,296\,000 \text{ J}$ $= 1.3 \times 10^6 \text{ J}$	M1 A1
(b)	When the diameter is 20 m, the power is 500kW, but when the diameter is 40 m, the power is 2000 kW, which is 4 times the power.	B1 B1
(c)	$(500\,000 / 1\,296\,000) \times 100\%$ $= 38.5\% = 39\%$	A1
d	Intermittent power as it is not easy to find steady wind blowing.	B1
(e)	As the coils rotates, there is a change in magnetic flux linking to the coil which induces an e.m.f.	B1
(f)i	North	B1
ii	The magnitude of the induced e.m.f is proportional to the rate of the change of the magnetic flux in the circuit. As the magnet fall, it accelerates due to acceleration due to gravity. A larger speed will produce a larger rate of change of the magnetic flux in the circuit.	B1 B1
11a)i	Electrons from the brass cap repelled away and move to the brass plate and the gold leaf. Since the brass plate and the gold leaf have like charges (negative) they repel each other.	B1 B1
ii	Deflection decreases / Gold leaf moves back to original position	B1
iii	$I = Q / t$ $= 0.15 / 0.5 = 0.3 \text{ A}$	A1
11b)i	It is the work done to drive a unit charge across a component	B1
ii)	$E = VQ$ $80 = V \times 20$ $V = 4V$	A1
ci)	Wire moves downwards	B1

	Using Fleming's left hand rule where thumb is the force, first finger is the magnetic field and the middle finger is the current.	B1
cii)	There is no force on the wire / force F becomes zero.	B1
	The iron tube causes magnetic shielding, so there is no magnetic field around the wire JK.	B1
12 a)i)	Step down transformer Correct symbol of ac supply and lamp.	B1
ii	The a.c. supply produce a changing magnetic field in the primary coil. The changing magnetic field lines in the primary coil is linked to the secondary coil through the soft iron core.	B1 B1
iii	$V_p / V_s = N_p / N_s$ $24 / 2 = 300 / N_s$ $N_s = 25$	A1
iv	$P = IV$ $12 = I \times 24$ $I = 0.5 \text{ A}$	A1
b	The resistance of the resistor is constant while the resistance of the lamp is increasing as the potential difference increases. From 0 to 3.2 V, the resistance of the resistor is lower than the resistance of the lamp. Or Above 3.2 V, the lamp has a higher resistance than the resistor.	B1 B1
c	When connected in parallel, the lamp will be brighter. The lamps have higher voltage / higher current /and higher power.	B1 B1